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## (12) United States Patent Allin et al.

# (54) SYSTEM FOR DISCHARGING HEAT OUT OF HEAD-MOUNTED DISPLAY BASED ON HYBRID FAN AND HEAT PIPE

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This patent is subject to a terminal dis-

claimer.

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See application file for complete search history.

(56) References Cited

#### U.S. PATENT DOCUMENTS

#### FOREIGN PATENT DOCUMENTS

CN 106163241 A 11/2016 CN 205958846 U \* 2/2017 (Continued)

#### OTHER PUBLICATIONS

PCT International Search Report and Written Opinion, PCT Application No. PCT/US2017/030630, dated Jan. 10, 2018, 16 pages.

(Continued)

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#### (57) ABSTRACT

A head-mounted display (HMD) includes a hybrid fan, a printed circuit board (PCB) with one or more electronic components and a heat pipe to dissipate heat. The hybrid fan has a center axis extending from a rear side of the HMD to a front side of the HMD. The hybrid fan pulls air from a rear side of the HMD. The heat pipe has an end coupled to the PCB. The heat pipe partially surrounds a periphery of the hybrid fan and transfers heat away from at least the PCB. The HMD further includes a side cover and a front cover. The side cover encloses the hybrid fan, the PCB and the heat pipe. The front cover is attached to the side cover with a slit between an outer edge of the front cover and an outer edge of the side cover to discharge air from the hybrid fan.

### 20 Claims, 5 Drawing Sheets

